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The communicative importance of agent-backgrounding: Evidence from homesign and Nicaraguan Sign Language

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ABSTRACT

Some concepts are more essential for human communication than others. In this paper, we investigate whether the concept of *agent-backgrounding* is sufficiently important for communication that linguistic structures for encoding this concept are present in young sign languages. Agent-backgrounding constructions serve to reduce the prominence of the agent – the English passive sentence *a book was knocked over* is an example. Although these constructions are widely attested cross-linguistically, there is little prior research on the emergence of such devices in new languages. Here we studied how agent-backgrounding constructions emerge in Nicaraguan Sign Language (NSL) and adult homesign systems. We found that NSL signers have innovated both lexical and morphological devices for expressing agent-backgrounding, indicating that conveying a flexible perspective on events has deep communicative value. At the same time, agent-backgrounding devices did not emerge at the same time as agentive devices. This result suggests that agent-backgrounding does not have the same core cognitive status as agency. The emergence of agent-backgrounding morphology appears to depend on receiving a linguistic system as input in which linguistic devices for expressing agency are already well-established.

1. Introduction

We can conceptualize a far greater range of thoughts than we have words or syntactic structures to express. When a linguistic structure does encode a concept, this provides insight into the importance of the concept: that it is relevant given a particular social or ecological environment, cognitively prominent, or useful in facilitating communication (see Gibson et al., 2017; Levinson & Majid, 2014; Majid et al., 2018; Regier, Carstensen, & Kemp, 2016 for review). Understanding which concepts have high priority for linguistic encoding across languages and cultures is a central goal of cognitive science. A related goal is understanding how semantic structures (i.e., form/meaning mappings) relate to each other within a language: whether linguistic encoding of a particular concept depends on a related concept also having linguistic encoding. For example, dual number marking is only found in languages that also have plural number marking (see Greenberg, 1963, Universal 34).

In this paper, we address these issues by studying the emergence of semantic structures in the community sign language Nicaraguan Sign Language (NSL) and in the gestural systems of individual adult homesigners, deaf individuals who have learned neither a signed nor a spoken language, but who nevertheless communicate via their own gesture systems, called “homesigns” (Coppola & Newport, 2005; Feldman, Goldin-Meadow, & Gleitman, 1978; Goldin-Meadow, 2003). Studying young sign languages allows us to observe which semantic structures emerge most readily in language, indicating that these concepts have high priority for linguistic encoding. For semantic structures that take longer to emerge, we can also observe in young sign languages

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the conditions that are necessary for the emergence of these structures (see Goldin-Meadow, 2010; Goldin-Meadow, Brentari, Coppola, Horton, & Senghas, 2015; Sandler, 2017).

The populations of signers that we studied constitute three stages of language emergence. First, homesigners create their homesigns in the absence of a linguistic community and without having received a language model as input. NSL signers constitute the second and third stages of emergence. In the late 1970s-early 1980s in Managua, a school for special education opened and served many deaf students who otherwise had not been exposed to a conventional sign language (Kegl & Iwata, 1989; Pölich, 2005; Senghas, 1995; Senghas, Senghas, & Pyers, 2005). The school was conducted in Spanish, which was inaccessible to the deaf students. Nevertheless, time at school gave students the opportunity to interact with other deaf individuals, and a new sign language, NSL, was born. Studies of NSL distinguish different “cohorts” of signers. The first cohort of NSL constitutes the group of previously homesigning children who began signing with other deaf peers for the first time when they entered the school. These individuals are part of a linguistic community but have not received a language model as input. Subsequent cohorts are delineated in roughly 10-year intervals, with each cohort entering the school as children and learning NSL from the previous cohort (Senghas, 2003; Senghas & Coppola, 2001). These subsequent cohorts have both a linguistic community and have received a language model from previous cohorts.

We ask whether signers at these different stages of emergence have innovated linguistic structures for expressing *agent-backgrounding*. An “agent” is often understood to be an animate individual who causes an event to occur. In an event of a waiter folding a napkin, for example, the waiter is an agent. The napkin is often described as filling the “patient” role. Language users have a range of available linguistic options to describe the multiple facets of events. Suppose a waiter reports to a restaurant manager *all the napkins have been folded*. The waiter is using passive voice, conveying the importance of the napkins while placing little emphasis on who specifically folded them. Passive voice is a type of *agent-backgrounding construction*. Agent-backgrounding is the conceptual representation wherein an agentive event is construed from the perspective of the patient rather than the agent.

Passive voice has received considerable attention in theories of syntax (Abraham & Leisiö, 2006; Baker, 1988; Kiparsky, 2013; Shibatani, 1985; Siewierska, 1984), and numerous studies have addressed how children acquire passive voice (Armon-Lotem et al., 2016; Demuth, 1990; Fox & Grodzinsky, 1998; Maratsos, Fox, Becker, & Chalkley, 1985; Messenger & Fisher, 2018). Cross-linguistically, there are a range of agent-backgrounding constructions beyond passive voice (Barberà & Hofherr, 2018; Siewierska, 2013). Nonetheless, few studies have investigated the typological prevalence of agent-backgrounding constructions or the emergence of agent-backgrounding constructions in new languages.

We compare the emergence of agent-backgrounding constructions in NSL and homesign against the emergence of agentive constructions in these sign systems. There is extensive evidence that humans have a core system representing agency (Carey, 2009). Almost without exception, languages mark a distinction between agents and patients morphosyntactically (Rissman & Majid, 2019). Infants as young as six months represent agentive individuals in events as having goals and causal efficacy (see Carey, 2009 for review). Linguistic structures for encoding agency have also been found to emerge early in young sign languages, including homesign (Coppola & Newport, 2005; Ergin & Brentari, 2017; Ergin, Meir, Aran, Padden, & Jackendoff, 2018; Flaherty, 2014; Goldin-Meadow et al., 2015; Horton, Goldin-Meadow, Coppola, Senghas, & Brentari, 2015; Horton, Rissman, Goldin-Meadow, & Brentari, 2017; Rissman & Goldin-Meadow, 2017; Sandler, Meir, Padden, & Aronoff, 2005). If a homesigner is shown to innovate linguistic devices for encoding a particular concept, this is evidence that the concept has a core cognitive status. For example, Gleitman, Senghas, Flaherty, Coppola, and Goldin-Meadow (2019) argued that homesigners' ability to linguistically distinguish symmetrical and reciprocal construals of events suggests a “common core of conceptual distinctions” and that “unlearned conceptual forces are at work in the creation of universally shared language structure” (6).

Whether agent-backgrounding has the same high priority for linguistic encoding as agency is far from clear. On the one hand, agent-backgrounding is conceptually dependent on agency: one cannot represent the former without representing the latter. Agent-backgrounding also involves flexibility of event representation, which is intuitively less fundamental than representing the mere presence of an agent. Indeed, some prescriptivist grammarians have discouraged the use of English passive voice altogether (see Ferreira, 2020 for review). It may be that agent-backgrounding constructions only emerge after many generations of transmission or never emerge in a particular language. On the other hand, it is logically possible that agent-backgrounding constructions emerge at the same time as agentive constructions. Gleitman et al. (2019) found that even homesigners distinguish symmetrical and reciprocal construals of events, a distinction which also involves flexibility of event representation.

We address three questions in this study. First, is agent-backgrounding communicatively important enough to arise in an emerging language? Second, if it is, does agent-backgrounding arise at the same moment as agency? Finally, at what point in the emergence of a language does agent-backgrounding arise – in the earliest stage when the language is used only with hearing individuals and thus is produced but not seen (i.e., in homesign), or when the language is shared among homesigners brought together for the first time (i.e., the first cohort of NSL), or only when the language is transmitted to a new set of learners (i.e., the second cohort of NSL and beyond)? Evidence from language emergence allows us to draw conclusions about the mapping from concepts to language beyond the particular signers studied here. First, if we observe agent-backgrounding constructions in early stages of language emergence, this finding would indicate that expressing agent-backgrounding is important in human communication. Unlike typical language learning where semantic structures are there to be learned, in language emergence, semantic structures must be *created*. Second, by studying these early sign systems, we can identify the conditions that are necessary for the emergence of agent-backgrounding constructions, suggesting more general dynamics of language creation and change.

1.1. Agency: typology and emergence

Like most human concepts, *agent* resists definition in terms of necessary and sufficient conditions (Dowty, 1991; Grimm, 2011; Levin & Rappaport-Hovav, 2005; van Valin & Wilkins, 1996). Following Dowty (1991) and others, we adopt the perspective that *agent* is a cluster concept, and that the prototypical agent is animate, acts intentionally, and plays a direct causal role in acting on an object. Linguistic devices for encoding the presence of an agent are widespread cross-linguistically. In English, for example, this function is achieved syntactically (e.g., the contrast between *the girl broke the balloon* and *the balloon broke*), as well as lexically (e.g., *push* requires an agent but *fall* is incompatible with one). Morphological marking of agency is also common across languages. The Russian example in (1) demonstrates case marking, where the agent receives nominative case and the patient accusative case (Comrie, 1989, Chp. 3, ex. 69):

(1)	Tanja	ubila	Mašu.
	Tanya-NOM	kill-PST	Masha-ACC
	‘Tanya killed Masha’		

The tendency to morphosyntactically distinguish agents from patients is a near typological universal (see Rissman & Majid, 2019 for review). For example, Hartmann, Haspelmath, and Cysouw (2014)

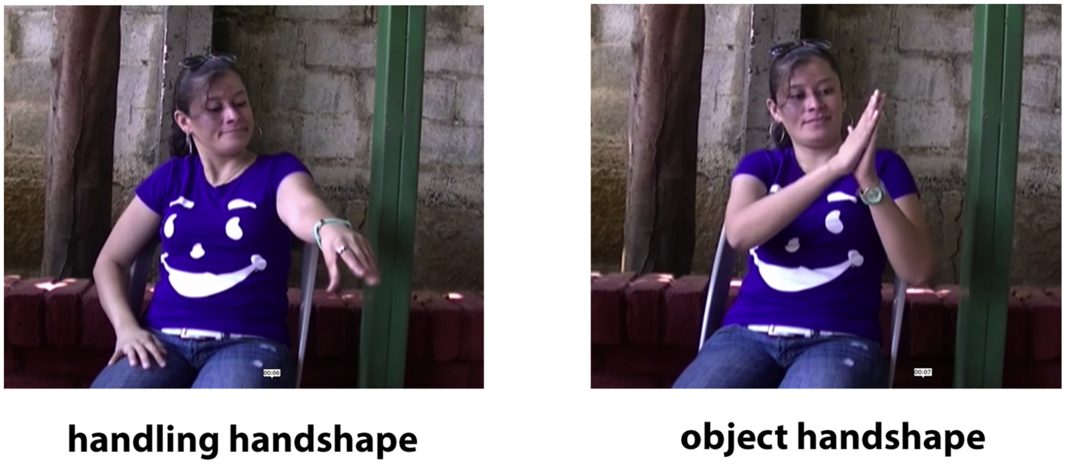

Fig. 1. NSL signer describing an event of someone tipping over a book. The predicate that encodes the motion of the event has either handling handshape (left panel) or object handshape (right panel).

studied 25 genetically diverse languages using multidimensional scaling and found that agentive roles clustered distinctly from patient roles. For the remainder of this paper, we understand an "agent" to be a prototypical agent: sentient, volitional and a causer.

Turning to the typology of agent-marking in sign languages, one common way of expressing agency is through handshape morphology in classifier predicates, sometimes called "spatial verbs" (Emmorey, 2003; Supalla, 1986). Fig. 1 shows an NSL signer producing classifier predicates with two different types of handshape morphemes.[1] In the left-hand panel, the signer is describing someone tipping over a book and is producing a predicate with *handling* handshape: the shape of the hand iconically represents how someone would hold a book. In the right-hand panel, the signer is describing the same event, but is producing a predicate with *object* handshape: the shape of the hand represents the shape of the book itself.

Example (2) shows an utterance from American Sign Language (ASL) in which the predicate MOVE uses a handling handshape, and the interpretation of the utterance is agentive, even though no sign is produced labeling the agent (Benedicto & Brentari, 2004, p. 752, ex. 12a; in their notation, the subscript 'hdlg' denotes handling handshape).

(2) [ø]_ BOOK C + MOVE

pron:3sg book obj $\text{grab}_{\text{hdlg}}$ + move vert. > hor.

'S/he took the (standing) book and laid it down on its side'

Conversely, example (3) shows an ASL utterance where the MOVE predicate has object handshape (the subscript 'w/e,' or 'whole entity') and the interpretation is that the event does not have an agent (Benedicto & Brentari, 2004, p. 752, ex. 12b):

(3) BOOK B + MOVE

book 2D flat $\text{obj}_{\text{w/e}}$ + move vert. > hor.

'The (standing) book fell down on its side'

This pair of mappings, in which handling handshape is associated with the agent and object handshape with the patient, has been documented for a variety of established sign languages, including ASL (Benedicto & Brentari, 2004; Goldin-Meadow et al., 2015; Kegl, 1990), Catalan Sign Language (Benedicto, Cvejanov, & Quer, 2007), Argentinian Sign Language (Benedicto et al., 2007); Sign Language of the Netherlands (de Lint, 2018; Zwitserlood, 2003); Italian Sign Language (Brentari, DiRenzo, Keane, & Volterra, 2015; Mazzoni, 2008), British Sign Language (Brentari, DiRenzo, Keane, & Volterra, 2015), Russian Sign Language (Kimmelman et al., 2019; Kimmelman, Pfau, & Aboh, 2019), German Sign Language (Kimmelman, de Lint, et al., 2019) and Hong Kong Sign Language (Brentari et al., 2015).

Linguistic typology provides one source of evidence about cross-cultural pressures to encode concepts in language. As described earlier, evidence from language emergence plays a complementary role. The majority of new languages that we are able to observe today are sign languages. Within emerging sign language communities, hearing loss typically prevents deaf individuals from having access to the spoken language(s) around them, particularly if they do not attend school (Coppola, in press). Moreover, the vast majority of deaf people are born into hearing families and do not have access to a sign language at home. Some deaf individuals never receive exposure to a natural sign language. Despite their lack of input from a language model, these individuals communicate with the hearing individuals in their worlds and use gesture to do so. These gestures, called "homesign systems," have been shown to have many, although not all, of the properties of natural language (Goldin-Meadow, 2003), including stable mappings between forms and meanings. Homesigners have been shown to encode a noun/verb distinction (Abner et al., 2019; Goldin-Meadow, Butcher, Mylander, & Dodge, 1994; Hunsicker & Goldin-Meadow, 2013), proposition-level negation (Franklin, Giannakidou, & Goldin-Meadow, 2011), motion event categories (Zheng & Goldin-Meadow, 2002), the grammatical relation of subject (Coppola & Newport, 2005), a singular/plural distinction (Coppola, Spaepen, & Goldin-Meadow, 2013) and causation (Rissman & Goldin-Meadow, 2017). Homesign thus represents an early stage of language emergence (Coppola & Senghas, 2010). Homesign provides both evidence about what meanings are conveyed in early communication systems (e.g., a singular vs. plural distinction) and how these systems are structured in terms of their phonology, morphology and syntax (e.g., a grammatical subject relation).

As with homesign, NSL provides evidence about which concepts have high priority for linguistic encoding. As described earlier, the first cohort of NSL were previously homesigning children who joined a linguistic community in the context of their school. Subsequent cohorts of NSL learned the structures that the previous cohort had created and also introduced their own innovations. Interestingly, a variety of form/meaning mappings are present only among subsequent cohorts of NSL (i.e., the learners): some mental state verbs (Pyers & Senghas, 2009), a consistent marker of left-right spatial relations (Pyers, Shusterman,

[1] We use the label "morpheme" to refer to a formal component of a sign that corresponds to a specific meaning.

Senghas, Spelke, & Emmorey, 2010), and ordinal numbers used to convey the temporal sequence of an event (Kocab, Senghas, & Snedeker, 2016). Spatial modulations are also more frequent among later cohorts (Senghas & Coppola, 2001). By comparing older generations of signers to younger generations, we can observe which semantic structures take longer to emerge and what conditions support the emergence of these structures.

Signers of emerging sign languages have been shown to use handshape morphology to encode agency. The association between handling handshape and agency has been observed among child homesigners (Coppola & Brentari, 2014; Horton, 2018; Horton et al., 2017; Rissman & Goldin-Meadow, 2017), adult homesigners (Goldin-Meadow et al., 2015), first and second cohort signers of NSL (Goldin-Meadow et al., 2015), and first, second and third cohort signers of Central Taurus Sign Language (Ergin & Brentari, 2017). The observation that morphosyntax for encoding agency emerges early in new languages, taken together with the fact that agent-marking is typologically prevalent, provides strong evidence that encoding agency has high priority in linguistic systems.

1.2. Agent-backgrounding: typology, emergence and evolution

We ask in this paper whether agent-backgrounding has the same high priority for encoding in linguistic systems as agency. Describing the actions of agents is no doubt useful in communication. Agent-backgrounding constructions, for their part, allow language users to comment that an agentive event has happened, while remaining vague about the precise cause (e.g., when a shipping company informs you that *your package has been misplaced*). Across languages, there is a strong tendency for both events and sentences to have an agent-oriented construal by default (see Prat-Sala & Branigan, 2000; Riesberg, Malcher, & Himmelmann, 2019 for review). For example, in descriptions of agentive events, the agent is more likely than the patient to be mentioned in subject position in English (Gleitman, January, Nappa, & Trueswell, 2007; Prat-Sala & Branigan, 2000), Dutch (Vogels, Krahmer, & Maes, 2013) and German (van Nice & Dietrich, 2003).[2] However, viewing an agentive event from the perspective of the patient is also possible, as reflected in the passive sentence *your package has been misplaced*, where the patient "package" occupies subject position. We use the phrase "agent-backgrounding construction" to refer to any linguistic structure that orients an event of an agent acting on a patient away from the agent.

Across languages, agent-backgrounding is expressed in a diverse range of syntactic forms. Passive morphosyntax is by far the best-studied agent-backgrounding construction and is common cross-linguistically. Nonetheless, passive morphosyntax is much more circumscribed than agent-marking: of 373 languages sampled on the World Atlas of Linguistic Structures (WALS), only 44% feature a passive construction (Siewierska, 2013). Passives, however, are typically defined using syntactic criteria (Haspelmath, 1990; Kulikov, 2011; Siewierska, 2013) and, across languages, there are many types of agent-backgrounding constructions that achieve the backgrounding function but do not fit the syntactic criteria of a passive (Givón, 2009; Shibatani, 2006; Siewierska, 2013). These devices include middles, impersonals, serial verb constructions, and even simple agent omission, as in Awtuw (Feldman, 1986). The Mandarin example in (4) demonstrates use of a serial verb construction to convey agent-backgrounding. The verb *bei* 'suffer,' was originally used in a passive construction to describe an adverse event, such as someone being fired, but is increasingly being used as a more generic passive for events that are not adverse (Givón, 2009, p. 47, ex. 3b; Li & Thompson, 1981):

(4)	sheng-cheng	bei	jiefang-le
	province-capital	suffer	liberate.PF

'the provincial capital was liberated'

(lit.: 'the provincial capital suffered (when someone) liberated it')

In established sign languages, a range of linguistic devices express agent-backgrounding, including agent omission, role shift, use of a non-neutral or semantically empty spatial locus, topic verb constructions, and averted eyegaze (Barberà & Hofherr, 2017, 2018; Guitteny, 2006; Janzen, O'Dea, & Shaffer, 2001; Kegl, 1990; Rankin, 2013; Saeed & Leeson, 1999; Sze, 2010). Argument-drop is attested in sign languages (Bahan, Kegl, Lee, MacLaughlin, & Neidle, 2000; Lillo-Martin, 1986), and omitting the agent argument is another way of deemphasizing the agent. As in spoken languages, impersonal constructions are well-attested in sign languages (see Barberà & Hofherr, 2018 and other articles in the same issue). In Hong Kong Sign Language, for example, the non-specific indefinite determiner $\text{ONE}_{\text{DET-PATH}}$ and the Chinese character sign HUMAN/PERSON have a non-referential function and serve to background the agent (Sze & Tang, 2018). Thus across languages, agent-backgrounding constructions range from the relatively complex syntactically (e.g., passive voice) to the relatively simple (e.g., agent omission).

The cross-linguistic literature provides a wealth of evidence about how different languages convey agent-backgrounding. This literature does not, however, provide a straightforward answer to the question of whether agent-backgrounding has high priority for encoding in language. We are not aware of any quantitative assessment of what percentage of the world's languages contains agent-backgrounding constructions, nor are we aware of any language that has been claimed to not have an agent-backgrounding construction. Given the current literature, it may therefore be true that agent-backgrounding constructions are just as common as agentive constructions. At the same time, the current evidence is also compatible with the alternative, that marking agent-backgrounding is less common than marking agency.

The studies cited in Section 1.1 on agent-marking in young sign languages provide a hint that these languages might use handshape morphology to encode agent-backgrounding. In these studies, handling handshapes are used exclusively in agentive contexts, whereas object handshapes are used in both agentive and non-agentive contexts (Brentari et al., 2015; Goldin-Meadow et al., 2015). One reason for this pattern might be that these studies used a set of stimuli in which the agent is visually backgrounded: only an arm or hand manipulating an object, rather than the whole agent's body being visible. If object handshapes for this set of stimuli were serving an agent-backgrounding function, this finding would indicate that agent-backgrounding has high priority for linguistic encoding.

Alternatively, a reconstructed model of language evolution based on historical change in languages suggests that agent-backgrounding has lower priority for linguistic encoding than agency. Grammaticalization theorists propose general principles and pathways by which words take on new meanings and morphosyntactic behavior over time (Bybee, Perkins, & Pagliuca, 1994; Heine, Claudi, & Hünnemeyer, 1991; Heine & Kuteva, 2002; Janzen, 2012; Narrog & Heine, 2011; Pfau & Steinbach, 2011). Drawing on grammaticalization pathways for over 500 languages, Heine and Kuteva (2007) propose a reconstruction of how language evolved. In this model, nouns emerged first, then verbs, then adjectives and adverbs, then a range of other grammatical categories (see also Hurford, 2012). Crucially, case markers (which mark agents, among other roles) evolved before passive markers (a type of agent-backgrounding construction). Although a range of other morphosyntactic elements convey each of these meanings, this pattern of grammaticalization across languages raises the possibility that marking agency was evolutionarily prior to marking agent-backgrounding.

[2] Agents have been argued to be more *conceptually accessible* than patients (Bock & Warren, 1985; van Nice & Dietrich, 2003).

1.3. Research approach

We compare the emergence of agentive constructions against the emergence of agent-backgrounding constructions for two groups of signers: adult signers of NSL and adult homesigners from Nicaragua. We elicited descriptions of short video clips from these groups of signers. To assess how signers encode the presence of an *agent*, we contrasted descriptions of events where a person is seen acting on an object (e.g., a woman tipping over a book onto a table) against events where an object undergoes a change on its own and no person is present (e.g., a book falling over onto a table). The agents in our videos all have the properties of a prototypical agent, as defined in Section 1.1. In addition, the patients in our videos are all inanimate objects that undergo change of location/configuration.

To assess signers' use of *agent-backgrounding* constructions, we used a perceptual manipulation: whether the face/torso of an animate agent was visible or not. A variety of factors influence whether an agentive event is viewed from an agent-oriented vs. patient-oriented perspective, including conceptual factors such as animacy, discourse and lexical factors, and perceptual factors such as the relative size of the event participants (see Bock & Ferreira, 2014; Prat-Sala & Branigan, 2000; Rissman, Woodward, & Goldin-Meadow, 2019 for review). Rissman et al. (2019) found that when English speakers describe events of an animate agent acting on an inanimate patient and they can see the face and torso of the agent, they almost always produce active descriptions, such as *a woman tipped over a book*. By contrast, when only the hand and forearm of the agent are visible on screen, English speakers are more likely to produce passive descriptions such as *a book was tipped over*. Rissman et al. (2019) argue that when the face/torso are occluded, the agent has lower conceptual accessibility and the event as a whole has a more agent-backgrounded construal. Another possibility is that English speakers produce more passive descriptions because they have insufficient information about whether the agent is a man or a woman. Studies on the discourse functions of passive have shown that the passive may be elicited in contexts where the exact identity of the agent is either unknown or unimportant (Jespersen, 1992 [1924]; Stein, 1979; Thompson, 1987). Obscuring the gender of the agent may thus promote agent-backgrounding language.

In the present study, signers described events where a person was seen manipulating an object. In *Body-Agent* events, the person's hands, face, and torso were visible during the vignette. In *Hand-Agent* events, only the person's hand and forearm were visible during the vignette and the manipulated object was larger in scale relative to the Body-Agent events. If signers describe the agent and patient in different ways across these two types of events (Body-Agent events vs. Hand-Agent events), we would have evidence for the emergence of agent-backgrounding language. We expect that signers will recognize the Hand-Agent events as agentive, as even 9-month-old infants interpret a hand as being connected to an agent (Saxe, Tzelnic, & Carey, 2007; Slaughter & Heron-Delaney, 2010; see also Wolff, 2003). In addition to these two types of agentive events, signers also described *No Agent* events. In these events, an object underwent a change seemingly on its own, such as a book falling over from an upright position. If signers distinguish No Agent events from Body-Agent events, we have evidence that signers linguistically encode the presence of an agent. No Agent events were matched with the agentive events in terms of the patient's change of state. For example, in one set of Body-Agent and Hand-Agent events, a person tips over a book, and in the corresponding No Agent event, the book falls over.

We analyzed two types of linguistic devices: (1) a lexical/pronominal device – production of agent nominals and (2) a morphological device – distribution of handshape in classifier predicates.[3] As noted earlier, omitting a lexical label for the agent has been demonstrated to be a feature of agent-backgrounding constructions in established signed languages (American Sign Language: Kegl, 1990; Janzen et al., 2001; Catalan Sign Language: Barberà & Hofherr, 2017). In prominent theories of language evolution, words (i.e., consistent mappings between a label and a referent) emerged before syntactic and morphological structures (Givón, 2009; Heine & Kuteva, 2007; Hurford, 2012). As a lexical strategy, agent omission may emerge early as a means of conveying agent-backgrounding.

To explore the second device, distribution of handshape in classifier predicates, we analyzed whether signers use handshape morphology in different ways across Body-Agent, Hand-Agent and No Agent events. As described in Section 1.1, an association between handling handshape and agency has been documented for multiple sign languages. Goldin-Meadow et al. (2015) found, however, that when adult homesigners and NSL signers described agentive events, they not only produced handling handshape predicates but they also produced a sizable proportion of object handshape predicates. One explanation for this finding is that signers used object handshape to emphasize the change of state of the patient, even for an agentive event. For example, in an event in which someone puts a pen down onto a table, producing a predicate with object handshape (i.e., an extended index finger) highlights the pen's change of location. Signers may therefore use a combination of handling and object handshape predicates productively to emphasize or deemphasize the agent as suggested by the context.

In addition to Body-Agent, Hand-Agent and No Agent videos, we included a fourth condition, an Event Control video. If linguistic devices for expressing agent-backgrounding have not yet emerged for a particular group of signers, then we expect that these signers will *not* use handshape to distinguish Body-Agent from Hand-Agent events, which would be a null effect (i.e., Body-Agent descriptions do not differ from Hand-Agent descriptions). However, a null effect might have little to do with agent-backgrounding, and might instead reflect general constraints on signers' descriptions, such as a dispreference for producing multiple predicates or a dispreference for producing both handling and object handshape predicates in a single trial. To control for these factors, we asked signers to describe agentive events that are strongly patient-oriented and we presented them in a Hand-Agent frame, thus further downplaying the agent. In these Event Control videos, the hand of an agent moves the patient into an unusual configuration, e.g., tipping a book onto its spine and then open. The complexity and oddity of the change undergone by the patient in these events makes the patient more conceptually prominent than the patient in the Hand-Agent events. We expected all signers to use handshape to emphasize the patient in these events. Note that Hand-Agent and Body-Agent videos display the same event from different perspectives. Event Control videos provide an index of whether a signer can emphasize the patient in an agentive event but, because they do not portray the event shown in the Hand-Agent and Body-Agent conditions, they do not test agent-backgrounding per se.

Turning to the signers themselves, we contrast three levels of language emergence, with adult homesigners constituting the first level – these individuals have each used their homesign system as a primary mode of communication for their entire lives with close hearing friends and family. Importantly, and in contrast to all signers of NSL, homesigners do not share their homesign system in the context of a linguistic community. Signers from the first cohort of NSL constitute the second level: these individuals share a sign system with deaf peers, but they had the task of reconciling multiple idiosyncratic homesign systems when this community was formed. Signers from the second and third

[3] As reviewed in Section 1.2, a variety of agent-backgrounding devices have been attested in sign languages (e.g., eye gaze, role shift). We analyzed agent nominals and classifier handshape because these devices have been documented as being used by NSL signers to encode agency (Coppola & Senghas, 2010; Goldin-Meadow et al., 2015).

cohorts of NSL constitute the third level: these individuals are members of a signing community and also received a signed model from the previous generation of NSL. We report the results from the NSL signers in Experiment 1 and the homesigners in Experiment 2. In Experiment 3, we report how English speakers describe these stimuli when they can use only their hands to do so – this study explores how limitations on communicative modality constrain the range of concepts that language users can express.

2. Experiment 1: NSL

2.1. Participants

We tested 18 signers in total. Eight participants were from the first cohort of NSL (NSL 1; F = 3; age: mean = 42 years, range = 37–48 years). These signers all entered school before age seven (mean = 4.4, range = 2.1–6.2 years). We also tested 10 participants from the second and third cohorts of NSL (NSL 2 & 3; F = 5; age: mean = 28, range = 21–33), who all entered school before age five (mean = 3.5, range = 2.1–4.7 years). Of these 10 signers, six were from the second cohort and four were from the third cohort. Since our question was whether exposure to a language model influences emergence of agent-backgrounding devices, we collapse the data from the second and third cohort signers in our analyses.

2.2. Design and materials

Participants described four types of videos: (1) In Body-Agent videos, a person acted on an object (e.g., a woman tipped over a book), and the person's face, torso and hands were visible throughout the video. (2) In Hand-Agent videos, a person's hand entered the video frame from off screen, performed the same action as in the Body-Agent videos (e.g., tipping over a book), and then exited the frame. (3) In No Agent videos, the object moved on its own (e.g., a book fell over), with no person visible in the video. (4) In Event Control videos, a person's hand entered the frame from off screen but performed an unusual action on the object (e.g., opening the book while tipping it forward on its spine). In the Body-Agent videos, the patient is smaller relative to the video frame than the patient in the other three conditions. As discussed in Section 1.3, relative size of event participants is one influence on the use of agent-backgrounding constructions. The absence of the face/torso is another influence: Rissman et al. (2019) found that even when the size of the patient is held constant, occluding the body of the agent leads English-speakers to produce more passive descriptions. We constructed stimuli that differ on both of these dimensions to increase the likelihood that NSL signers would produce agent-backgrounding constructions. Fig. 2 shows still images from each of these four conditions. Previous work on emergence of agentive devices in sign languages used stimuli with only the hand/arm visible, and with the objects the same size in all of the vignettes (Coppola & Brentari, 2014; Brentari, DiRenzo, et al., 2015; Goldin-Meadow et al., 2015).

Experiment 1 had a blocked within-subjects design in which participants viewed Hand-Agent videos, then Event Control videos, then Body-Agent videos, then No Agent videos. We chose this blocking to maximize the chance that participants would produce agent-backgrounding constructions. We reasoned that if participants saw Body-Agent videos first, they would receive information about the personhood of the agents (e.g., male, balding), which could prime them to produce more agentive language in the Hand-Agent and Event Control conditions. Prior to the Hand-Agent block, participants saw a block containing static images of the opening frame of the Hand-Agent videos. No people were present in these static images. The purpose of this block was to familiarize participants with the objects in the videos and to identify which labels participants used to describe the objects. The descriptions of these static images are not reported in the analysis.

There were five different types of items (featuring three different

Fig. 2. Still images from videos in each of the four experimental conditions. The black box demarcates the three main conditions of interest. The Event Control condition, which displays a conceptually prominent patient in a Hand-Agent frame (which also highlights the patient), was included to ensure that participants have devices that focus on the patient.

agents) across the four video conditions: (1) a woman tipping over a book/a book falling/a woman opening a book while pushing it onto its spine, (2) a man spinning a tire on a string/a tire spinning on a string/a man lifting a tire on a string onto a hook, (3) a woman opening a dresser door/a dresser door swinging open/a woman pushing a dresser onto its side, (4) a woman pushing a tube down into water/a tube sinking in water/a woman pushing down and rotating a tube in water, and (5) a man pushing a marker down a ramp/a marker rolling down a ramp/a man pushing a marker down a ramp and standing it on its side.

Several participants reported that they did not understand what was happening in the events where someone pushed a tube down into water. Given this ambiguity, we excluded all of the tube events from the analysis.

In addition to the test items, each participant also described 18 filler videos. In half of the fillers, a person was performing a repeated activity, such as jumping or spinning in place (Activity fillers); in the other half, an inanimate object was undergoing an action with no obvious start or endpoint, such as a flag waving or water running in a faucet (Object fillers). The purpose of these fillers was to increase the variety in the stimuli and decrease the possibility that participants would become consciously aware of the structure of the task, which could prime them to linguistically distinguish the conditions. These fillers were also intended to encourage participants to produce both person-oriented sentences (for the Activity fillers) and object-oriented sentences (for the Object fillers). The fillers were presented randomly throughout the five blocks of the experiment (static block + 4 video blocks). Summing across all stimuli, participants saw 43 images/videos. All participants saw the stimuli in the same order.[4] Each video was approximately 3–4 s long.

2.3. Procedure

Videos were displayed on a laptop computer positioned on a table to the side of the participant. After each video played, a gray screen appeared, and the participants described what they had seen to a signer of similar age. An experimenter was seated next to the computer and presented the next trial after the participants had completed their descriptions. Participants were free to provide a description of any length for each of the videos. Participants were filmed via a single video camera placed directly opposite them.

2.4. Coding

Videos of the participants' descriptions were coded using the annotation software ELAN (Crasborn & Sloetjes, 2008). We annotated each sign that was produced, and we present here analyses for two categories of signs: *agent nominals* and *event descriptions*. We coded three types of agent nominals: first, *agent labels*, which included the following conventionalized NSL signs MAN, WOMAN, GLASSES and PERSON.[5] Second, points to the chest, which Coppola and Senghas (2010) analyzed as a switch-reference device marking the subject. Third, the NSL person classifier sign, in which the index and middle finger are in the shape of an inverted V. Signs were considered *event descriptions* if they iconically represented the action displayed in the vignette and if they were produced in the signing plane which corresponded to the plane in which the event took place (see Brentari, Coppola, Mazzoni, & Goldin-Meadow, 2012). For reasons of convenience, we refer to event description signs as “predicates.”

Each event description predicate was coded for how the handshape of the dominant hand represented the patient in each video (i.e., the book, tire, dresser or marker; see Fig. 2). We coded the following handshape categories: *handling*, where the hand represented how the patient was manipulated in the video; *object*, where the hand represented the shape either of the entire patient (e.g., a flat palm representing a book) or a subpart of the patient (e.g., a curved hand representing the edge of a tire); and *place-holder*, where the hand traced the path of motion but represented none of the features of the agent/patient (e.g., an extended index finger resembling a pointing gesture). Since we were interested in how signers encode agency, we collapsed the categories *object* and *place-holder* into the overarching category *non-handling* in our analysis, as neither of these handshape types encodes features of the agent. In addition to these three handshape types, we also coded a *sequential handling–non-handling* category, where for a single sign, the hand transitioned mid-stroke from a handling to a non-handling shape; and an *ambiguous* category, where the handshape could be representing either a person manipulating an object or the object itself (e.g., two curved hands forming a circle, representing either lifting a tire or the shape of the tire itself). The stimuli were designed to minimize this type of ambiguity. Predicates with ambiguous handshape were excluded from analysis. Table 1 shows the rates at which participants produced each of these handshape types. Note that signers often produced more than one predicate in each trial.

The data were coded by a research assistant, who met with the first and second authors to discuss any unclear responses. To assess reliability of the coding, a second research assistant who was familiar with the coding scheme but was not part of these discussions, and was unfamiliar with our research questions, coded a random 10% of the NSL trials. There was 100% agreement between the two coders as to whether the trial contained an agent nominal. For event descriptions, a sign was scored as a match if the two coders agreed both as to whether the sign was an event description and as to the handshape type of the sign. Across all signs produced, there was a 94% agreement rate with respect to these criteria.

2.5. Results

2.5.1. Agent omission analysis

All 18 NSL signers produced at least one agent nominal during the experiment. Only one NSL 2 signer produced agent nominals in the No Agent condition (the sign PERSON immediately followed by the lexical sign NOTHING, negating the agent label). In contrast, agent nominals were produced for all three types of agentive events. This result makes it clear that NSL signers can and do use lexical devices to encode agency. The bars in Fig. 3 show the average proportion of trials where agent labels, points to chest and person classifiers were produced for each cohort and for each of the three agentive conditions (Body-Agent, Hand-Agent, Event Control). The circles in Fig. 3 show the average proportion of trials where signers produced at least one agent nominal.

In Fig. 3, we see that NSL signers produced agent nominals on most, but not all, Body-Agent trials. For both cohorts, agent labels were by far the most common type of agent nominal. Across the four signs that we coded as agent labels, the signs MAN and WOMAN were most common (MAN: 62%, WOMAN: 35%, GLASSES: 2%, PERSON: 1%). We modeled the differences across the three agentive conditions using mixed effects logistic regression and the *lme4* package for R (Bates & Maechler, 2009; R Core Team, 2017), modeling whether or not a signer produced at least one agent nominal per trial. Each model included random intercepts for Subject and Item. Possible fixed effects were Condition (Body-Agent vs. Hand-Agent vs. Event Control) and Cohort (NSL 1 vs. NSL 2 & 3). Models were evaluated through nested model comparison.[6] We

[4] Rissman et al. (2019) found that English speakers produced more passive descriptions for Hand-Agent events than Body-Agent events with a different set of stimuli. To verify that the stimuli in the current study elicited a similar contrast in the particular blocked design we used, we asked 27 English speakers on Amazon Mechanical Turk to describe our stimuli. We observed the following rates of passive sentences in each of the video conditions: Body-Agent: 4%, Hand-Agent: 17%, No Agent: 1%, Event Control: 33%. These percentages are comparable to those reported by Rissman et al. and validate that both Hand-Agent and Event Control videos are more patient-oriented than Body-Agent videos.

[5] The agent in the Body-Agent videos that featured a dresser was wearing glasses. We included the sign GLASSES to maintain compatibility between the homesign and NSL analyses; however, GLASSES only appeared twice among the 106 NSL agent labels.

[6] Starting with an intercept-only model, if the addition of a particular factor significantly increases the likelihood of the model according to the log-likelihood ratio test, this indicates a main effect of this factor (Quené & van den Bergh, 2008). Given two models that differ by one independent variable, the

Table 1
Mean number of predicates per trial and proportion of total predicates with each handshape type by signer group, averaged across all conditions.

Participant group	N	# of predicates	Predicates per Trial	Handshape types				
				Handling	Non-handling		Sequential handling– non-handling	Ambig
					Object	Place-holder		
NSL cohort 1 (Exp 1)	8	219	1.7	0.47	0.31	0.16	0.05	0.00
NSL cohorts 2 & 3 (Exp 1)	10	275	1.7	0.39	0.44	0.13	0.04	0.00
Homesigners (Exp 2)	4	94	1.5	0.26	0.49	0.24	0.00	0.01
Silent gesturers (Exp 3)	12	252	1.3	0.50	0.26	0.23	0.01	0.00

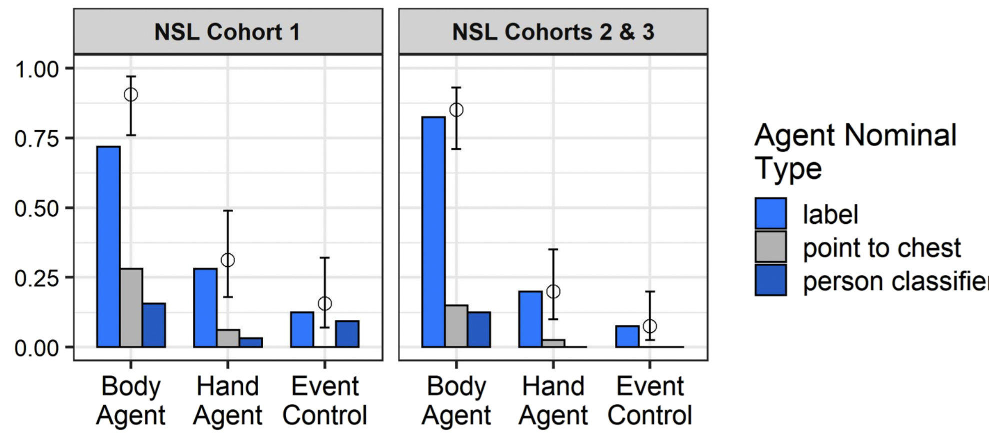

Fig. 3. Proportion of trials on which NSL signers (Cohorts 1 and 2 & 3) produced each type of agent nominal across the three agentive conditions. Circles show the proportion of trials where signers produced at least one agent nominal. Error bars show binomial 95% confidence intervals calculated using the Wilson method.

attempted to fit models including by-Subject and by-Item random slopes but these models did not converge, perhaps due to our small sample size.

The best-fitting model of the NSL data included the Condition fixed effect but not the Cohort effect or the interaction between Condition and Cohort. NSL signers were more likely to produce at least one agent nominal in the Body-Agent condition than in the Hand-Agent condition ($\beta = -3.9$, SE = 0.6, $p < .001$) or the Event Control condition ($\beta = -5.2$, SE = 0.7, p < .001). At the individual level, seven out of eight NSL 1 signers were more likely to produce an agent nominal in the Body-Agent condition than in the Hand-Agent condition (the remaining NSL 1 signer always produced agent nominals in these two conditions). Similarly, nine out of ten NSL 2 & 3 signers were more likely to produce an agent nominal in the Body-Agent than in the Hand-Agent condition (the remaining signer produced agent nominals for all of these trials). NSL 1 and NSL 2 & 3 signers thus robustly use agent omission as a lexical strategy to encode agent-backgrounding.

To assess whether there was a trade-off between signs for the agent and signs for the patient, we analyzed whether signers' production of patient nominals (e.g., BOOK, MARKER) differed across conditions and cohorts. We counted as patient nominals both conventionalized lexical signs and classifiers referring to the patient (e.g., signs tracing the tire hanging from the string). Rates of producing patient nominals were high across conditions and cohorts. Averaging across cohorts, the rate of producing at least one patient nominal per trial was 81% in the Body-Agent condition, 97% in the Hand-Agent condition, 89% in the No Agent condition and 81% in the Event Control condition. We analyzed these data using mixed effects logistic regression as above, with Body-Agent as the reference level for the Condition effect. We found a significant main effect of Condition but no effect of Cohort or interaction between Condition and Cohort. Signers were more likely to produce a patient nominal in the Hand-Agent condition than in the Body-Agent condition ($\beta = 2.6$, SE = 1.1, $p < .05$). This may indicate a trade-off between production of agent and patient nominals. Nonetheless, it is difficult to interpret this finding as showing that NSL signers use patient production to mark the prominence of the patient, as there was no difference between the Body-Agent condition and either the No Agent or Event Control conditions. Recall that the Hand-Agent events were the first video block that signers saw. It may be that signers almost always produced patient nominals for these videos because it was the first time they were seeing each type of vignette.

2.5.2. Predicate handshape analysis

We next tested whether NSL signers use handshape morphology in their event descriptions to encode agentive and agent-backgrounding construals. Given the literature reviewed in Section 1.2, we predict that all cohorts of NSL will use handshape to distinguish agentive events from non-agentive events: handling handshapes for Body-Agent events, and non-handling handshapes for No Agent events. These results would support the core conceptual status of agency. If agent-backgrounding has the same priority for linguistic encoding as agency, we expect to find that agent-backgrounding constructions will be used by all groups of signers to distinguish Body-Agent from Hand-Agent events. In addition, we expect that all groups will distinguish Body-Agent videos from Event Control videos because of the unusual change of state in the patient in the control videos (which makes the patient likely to be noticed and described).

As a primary analysis, we analyzed the number of handling and non-handling predicates that signers produced for each trial, and whether the number varied across the four conditions. For this analysis, *sequential handling–non-handling* signs, where the sign transitions mid-stroke from a handling to a non-handling handshape, were counted

(*footnote continued*)
difference between the log-likelihoods of these models multiplied by -2 is distributed as a chi-squared random variable with df = 1.

twice, once as a handling predicate and once as a non-handling predicate.[7] Fig. 4 presents the average number of handling and non-handling predicates produced per trial by each cohort of NSL signers. We analyzed the predicate frequency data using mixed effects models and the *lme4* package for R, assuming an underlying Poisson distribution (Coxe, West, & Aiken, 2009; Gardner, Mulvey, & Shaw, 1995). We fit separate models for the handling and non-handling predicate data. For this first analysis, we treated these two handshape types as distinct dependent variables, as signers have the option of producing either type of handshape, or both types. The possible fixed effects for each model were Cohort (NSL 1 vs. NSL 2 & 3) and Condition (Body-Agent vs. Hand-Agent vs. No Agent vs. Event Control). We chose Body-Agent as the reference level, as this is the most unambiguously agentive condition. We included random intercepts for Subject and Item.[8] We attempted to fit models including by-Subject and by-Item random slopes but these models did not converge, perhaps due to our small sample size.

We first modeled production of non-handling handshapes. The Condition effect contributed significantly to the model ($\chi^2(3) = 35.1$, $p < .001$) but the Cohort effect did not ($\chi^2(1) = 1.6$, $p = .2$). NSL signers produced more non-handling predicates in each of the three non-Body-Agent conditions than in the Body-Agent condition (Hand-Agent: $\beta = 0.47$, SE = 0.21, $p = .02$; Event Control: $\beta = 0.89$, SE = 0.19, $p < .001$; No Agent: $\beta = 0.96$, SE = 0.19, $p < .001$). We did not find evidence that one cohort produced more non-handling handshapes than the other.

Our principal question in this study was whether NSL 1 and NSL 2 & 3 signers differ in how they distinguish the Body-Agent vs. Hand-Agent events. To test whether an interaction between Cohort and Condition (particularly Body-Agent vs. Hand-Agent) modulated production of non-handling handshapes, we added the interaction term (Cohort x Condition) to the model with the Condition fixed effect. In this model, the significant main difference between the Body-Agent and Hand-Agent conditions disappears and a marginally significant interaction between the Hand-Agent level and Cohort emerges ($\beta = 0.52$, SE = 0.28, $p = .06$). This result suggests that NSL 2 & 3 signers are more inclined to produce non-handling handshapes when the face of the agent is occluded than NSL 1 signers are. NSL 2 & 3 signers may thus be using non-handling handshapes to convey agent-backgrounding. None of the interaction terms for the three other levels of the Condition factor (Body-Agent, No Agent and Event Control) were significant.

Turning to NSL signers' production of handling predicates, the Condition effect contributed significantly to the model ($\chi^2(3) = 62.5$, $p < .001$) but the Cohort effect did not ($\chi^2(1) = 2.2$, $p = .14$). NSL signers produced fewer handling predicates in the No Agent and Event Control conditions than in the Body-Agent condition (No Agent: $\beta = -1.79$, SE = 0.29, $p < .001$; Event Control: $\beta = -0.39$, SE = 0.17, $p = .02$). Rates of handling handshape did not differ, however, between the Body-Agent and Hand-Agent conditions. We did not find evidence that one cohort produced more handling handshapes than the other.

As with the analysis of non-handling handshapes, we then modeled whether production of handling handshape in any of the four event conditions interacted with Cohort. We added the interaction term to the model with the Condition main effect and found that in the Event Control condition, NSL 2 & 3 signers were less likely than NSL 1 signers to produce handling handshapes ($\beta = -0.54$, SE = 0.27, $p = .04$). In this model with the interaction term, there is no significant main difference between the Body-Agent and Event Control conditions. None of the interaction terms for the three other levels of the Condition factor (Body-Agent, Hand-Agent and No Agent) were significant.

These results show that NSL signers use both handling and non-handling handshape to encode agency. For Body-Agent events, signers used an average of 1.2 handling and 0.5 non-handling predicates per trial. For No-Agent events, signers used 0.2 handling and 1.4 non-handling predicates per trial on average. The cohorts were not statistically different in how they used handshape to distinguish Body-Agent vs. No Agent events.

The cohorts did differ, however, in how they used handshape to convey agent-backgrounding. We found a marginal interaction such that the difference in production of non-handling handshapes between the Body-Agent and Hand-Agent conditions was greater for NSL 2 & 3 signers than for NSL 1 signers. This facility with agent-backgrounding language among NSL 2 & 3 signers extends to Event Control videos as well: here they primarily used non-handling handshapes, highlighting the prominence of patient in these events. Although NSL 2 & 3 signers produced numerically fewer handling handshapes in the Hand-Agent condition than in the Body-Agent condition, we did not find a significant main difference between these two conditions for handling handshapes or a significant interaction with Cohort.

For NSL 1 signers, the numerical difference in the use of non-handling handshapes between the Body-Agent and Hand-Agent conditions was small: 0.5 vs. 0.6 non-handling handshapes per trial in each respective condition. In a model of NSL 1 signers' production of non-handling predicates, this difference was not statistically significant ($\beta = 0.17$, SE = 0.34, $p > .1$). This null effect is not likely to reflect a general dispreference for producing a non-handling handshape for an agentive event, as NSL 1 signers readily did so in the Event Control condition. These results therefore suggest that NSL 1 signers do not use handshape in classifier predicates to convey agent-backgrounding.

In this first analysis, we computed average rates of predicate production, treating use of handling and non-handling handshapes as distinct dependent variables. In a second analysis, we analyze handshape use across an entire trial, providing a complementary perspective on the differences across the conditions. We classified each trial according to which handshapes it contained: only handling-handshape predicates; only non-handling-handshape predicates; or both handling and non-handling-handshape predicates. This analysis provides a view of the strategy used across an entire utterance, normalizing predicate frequency in favor of utterance type. For this analysis, a trial with a *sequential handling–non-handling* sign counted as a trial with both handling and non-handling-handshape predicates. Note that the vast majority of "both" trials contained two or more distinct handling and non-handling signs. Fig. 5 presents the average proportion of trials containing only handling, only non-handling, or both handling and non-handling predicates produced by each cohort of signers.

Both NSL 1 signers and NSL 2 & 3 signers tended to produce trials containing only non-handling handshapes in the No Agent condition, and only handling handshapes in the Body-Agent condition. However, the groups differed with respect to the Hand-Agent condition. NSL 1 signers displayed the same distribution of handshapes in the Hand-Agent condition as in the Body-Agent condition. In contrast, NSL 2 & 3 signers showed different distributions: they produced predominantly *both handling and non-handling* responses in the Hand-Agent condition, but predominantly produced *handling only* responses in the Body-Agent condition.

We evaluated these data using the Friedman rank sum test, a non-parametric statistic used for repeated measures designs with a

[7] Across all cohorts of NSL, 23 sequential handling–non-handling signs were produced: 5 in the Body-Agent condition, 2 in the Hand-Agent condition, 4 in the No Agent condition and 12 in the Event Control condition.

[8] We included both Subject and Item random intercepts following the practice of using the most maximal random effects structure that the data/design support (Barr, Levy, Scheepers, & Tily, 2013). Adding the Item intercept did not, however, significantly increase the likelihood of the model. Averaging across all conditions, NSL signers produced roughly the same number of handling and non-handling handshape predicates for each of the four items: the mean number of handling handshapes per trial ranged between 0.7 (book) and 0.9 (tire), whereas the mean number of non-handling handshapes ranged between 0.8 (dresser) and 1.2 (tire).

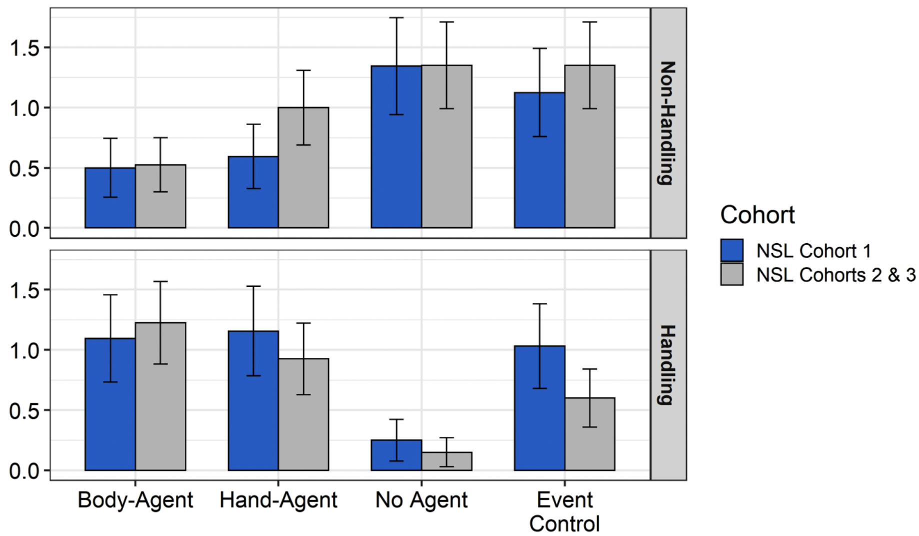

Fig. 4. Average number of non-handling and handling predicates produced per trial in each condition by each group of NSL signers. Error bars show Poisson 95% confidence intervals.

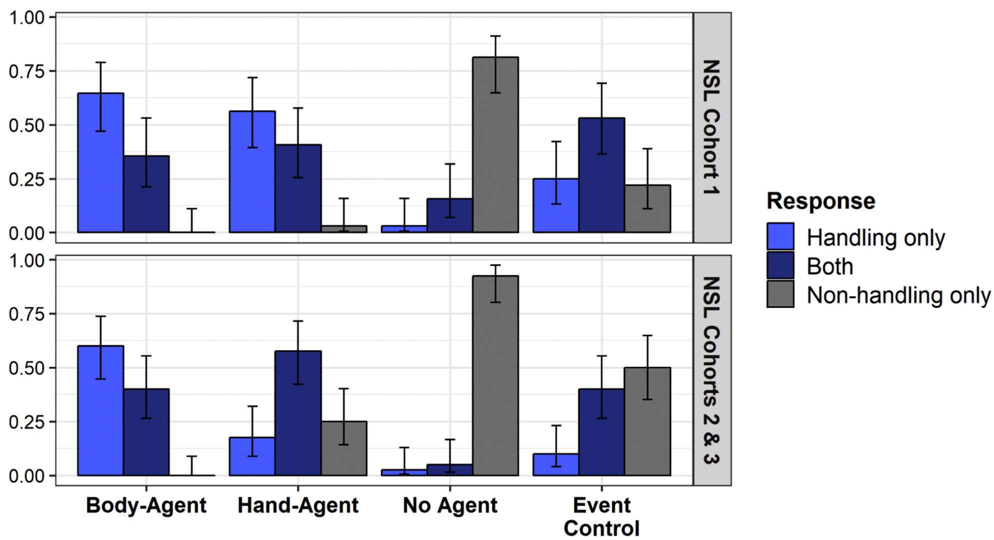

Fig. 5. Average proportion of trials containing only handling handshapes, only non-handling handshapes, or both handling and non-handling handshapes in each condition by each group of NSL signers. Error bars show binomial 95% confidence intervals calculated using the Wilson method.

multinomial outcome variable (Friedman, 1937; Siegel, 1956). We computed ranks by representing the three levels of the outcome variable as an ordinal scale from most-agentive to least-agentive (i.e., handling-only, both handling & non-handling, non-handling-only). We tested the two groups of signers separately. For both NSL 1 and NSL 2 & 3 signers, ranks were different across the four conditions, indicating main effects of condition on signers' response type (NSL 1: $\chi^2(3) = 46.8$, $p < .001$; NSL 2 & 3: $\chi^2(3) = 58.2$, p < .001). For both groups of signers, planned pairwise comparisons showed that ranks were significantly higher in the Body-Agent condition than in the No Agent condition (NSL 1: $\chi^2(1) = 26.3$, p < .001; NSL 2 & 3: $\chi^2(1) = 38.0$, p < .001). Ranks were also significantly different in the Body-Agent condition than in the Event Control condition (NSL 1: $\chi^2(1) = 5.3$, $p < .025$; NSL 2 & 3: $\chi^2(1) = 18.2$, p < .001). The two groups of signers differed, however, in the comparison between Body-Agent and Hand-Agent: For NSL 1, ranks were not significantly different between these two conditions ($\chi^2(1) = 0.5$, p > .1). For NSL 2 & 3, by contrast, the ranks were significantly higher in the Body-Agent than in the Hand-Agent condition ($\chi^2(1) = 12.1$, p < .001).

We examined the robustness of the difference between Body-Agent and Hand-Agent conditions (i.e., the robustness of the agent-backgrounding effect) in NSL 2 & 3 signers across individuals and across items. In terms of individuals, 8 of the 10 signers in this group produced more trials with *only* handling handshapes in the Body-Agent condition than in the Hand-Agent condition. The remaining two signers produced more trials with only *non*-handling handshapes in the Hand-Agent condition than in the Body-Agent condition. The agent-backgrounding effect was also robust across items in NSL 2 & 3 signers, as for all four of the items, there were more trials with *only* handling handshapes in the Body-Agent condition than in the Hand-Agent condition.

2.5.3. Word order and agent nominal/handshape interaction

We next analyzed whether NSL signers favor particular word orders for descriptions that contained both handling and non-handling predicates. As discussed in Section 1.3, serial verb constructions are one type of syntactic structure that can serve an agent-backgrounding function. It is possible that in NSL signers' "both" trials, the handling and non-handling handshapes are represented as a unit. Serial verb constructions involve multiple verbs that function as a single syntactic unit. Across languages, they have a range of characteristics: they can involve two or more verbs, the verbs can be adjacent or not, and the range of possible semantic relationships between the verbs is diverse (see Aikhenvald, 2006; Bisang, 2009; Haspelmath, 2016 for review). We are not yet able to determine whether NSL has serial verb constructions, as the prosodic and constituency diagnostics that indicate whether two verbs are part of the same clause, without any dependency relationship between them, are not yet available for NSL. Nonetheless, to gauge the existence of syntactic patterns in the "both" trials, we analyzed how often handling and non-handling predicates were signed consecutively. In the 70 "both" trials produced by NSL signers, 73% included a 2-predicate consecutive sequence, and an additional 17% included a 3-predicate consecutive sequence. Thus only 10% of "both" trials featured non-consecutive predicates, a syntactic regularity compatible with the interpretation that handling and non-handling predicates are part of a single syntactic unit. The non-consecutive-sequences were distributed evenly across NSL 1 and NSL 2 & 3 signers. The existence of a syntactic pattern in "both" trials is further supported by the order of predicates within the consecutive sequences. For 94% of 2-predicate sequences, the word order was [handling — non-handling].[9] This order is reminiscent of the "iconic" constituent order that has been proposed for serial verb constructions, where the verb encoding causation precedes the verb encoding result (see Aikhenvald, 2006). For 3-predicate sequences, the word order pattern is less clear: six different orders were produced, and the most frequent single word order was [handling — non-handling — handling].[10] We return to these results in Section 5.3 when we discuss how agent-backgrounding in NSL may continue to evolve.

We have thus far described in separate analyses how NSL signers use agent nominals and classifier handshape to convey agent-backgrounding. In a final analysis of the NSL data, we tested whether these two linguistic devices interact with each other. For example, do they play complementary roles, such that signers are more likely to produce an agent nominal for trials with only non-handling handshapes? We focused on the Hand-Agent condition for this analysis, as signers produced agent nominals on almost all Body-Agent trials (NSL 1: 91%; NSL 2 & 3: 85%). Table 2 is a 2 × 3 contingency table showing the number of trials with and without agent nominals for each of these three handshape response types (handling only, non-handling only, both handling and non-handling). Italicized values show what is expected by chance given the marginal distributions of agent nominal production and handshape type, whereas the bolded values show what was actually observed.

Using a 2 × 3 Freeman–Halton extension of the Fisher's exact probability test (Freeman & Halton, 1951), we did not find that cell values differed significantly from a chance distribution for either cohort (P_A = 0.79 for NSL 1; P_A = 0.67 for NSL 2 & 3). These data therefore suggest that for descriptions of Hand-Agent videos, production of agent nominals does not interact with handshape choice. NSL signers may instead be using these two devices as independent markers of agency/agent-backgrounding.

2.6. Discussion

Both groups of NSL signers robustly distinguish *agentive* from *non-agentive* events, using both lexical (nominals) and morphological (handshapes) strategies. They produce agent nominals in agentive events and omit them in non-agentive events; and they produce handling handshapes in agentive events and non-handling handshapes in non-agentive events. This result supports previous findings on NSL (e.g., Goldin-Meadow et al., 2015).

In terms of *agent-backgrounding*, both groups of NSL signers used the lexical agent omission strategy to encode agent-backgrounding (i.e., they produced many more agent nominals in the Body-Agent condition than in the Hand-Agent condition). However, only the second and third cohorts used handshape morphology to encode agent-backgrounding. The first cohort displayed the same distribution of handling and non-handling handshapes in the Body-Agent and Hand-Agent videos: more handling than non-handling handshapes in both Body-Agent and Hand-Agent videos. In contrast, the second and third cohorts used different distributions for these two conditions: more handling than non-handling handshapes in Body-Agent videos, but equal numbers (and more trials containing both handshapes) in Hand-Agent videos. The lack of agent-backgrounding in NSL 1 was not due to a dispreference for using non-handling handshapes to describe patient-oriented events, as NSL 1 used predominantly non-handling handshapes to describe the Event Control videos, which were patient-oriented.

We thus observed different types of semantic distinctions made in the lexicon versus in morphosyntactic structure. With respect to the lexicon, we do not observe an asymmetry in language emergence between encoding agency and encoding agent-backgrounding: signers with a language community but without a language model (NSL 1) used *agent nominals* to encode both semantic functions. We do observe an asymmetry, however, with respect to handshape morphology: only signers who learned from a language model (NSL 2 & 3) used *handshape* to encode agent-backgrounding.

We next investigate expression of agency and agent-backgrounding in adult homesigners. Testing these individuals will reveal whether strategies for encoding agency and agent-backgrounding emerge even among signers with neither a linguistic community nor a language model. To the extent that homesign constitutes an earlier stage of language emergence than cohort 1 NSL, we predict that homesigners will use handshape morphology to convey agentivity (Goldin-Meadow et al., 2015) but *not* use handshape morphology to convey agent-backgrounding. This finding cannot be taken for granted, however, as individual homesigners are able to innovate a range of linguistic structures (Coppola, 2002; Goldin-Meadow, 2003; Horton et al., 2017) and they display variability at the individual level (Abner et al., 2019;

Table 2
Contingency table for the Hand-Agent condition showing the distribution of trials with or without agent nominals across the three handshape response types. Italicized values are what is expected by chance; bolded values are observed data.

	Handling	Non-handling	Both	
NSL 1				
Agent nominal present	*6*	*0*	*4*	10
	5	**0**	**5**	
Agent nominal absent	*12*	*1*	*9*	22
	13	**1**	**8**	
	18	1	13	
NSL 2 & 3				
Agent nominal present	*1*	*2*	*5*	8
	1	**1**	**6**	
Agent nominal absent	*6*	*8*	*18*	32
	6	**9**	**17**	
	7	10	23	

[9] For this analysis, we excluded three trials in which one of the predicates in the 2-predicate sequence involved a sequential change from one handshape to another. These sequential predicates are difficult to interpret with respect to word order patterns.

[10] These multiple handling handshapes are morphosyntactically equivalent but not necessarily phonologically identical.

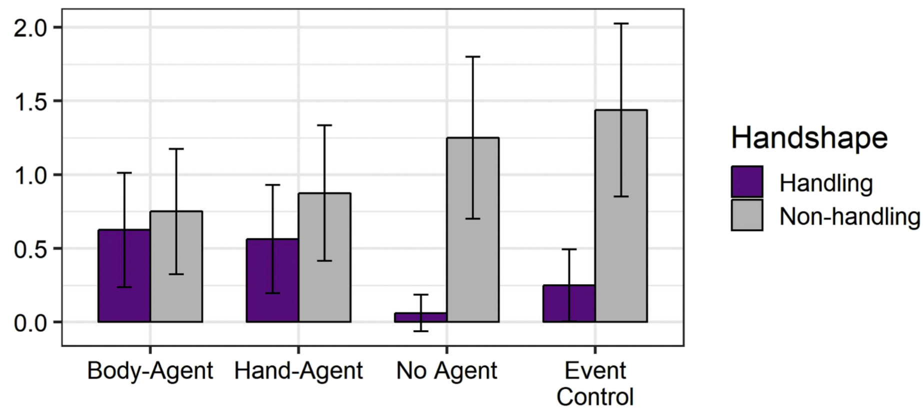

Fig. 6. Average number of handling and non-handling predicates produced by homesigners per trial in each condition. Error bars show Poisson 95% confidence intervals.

Coppola, 2002; Coppola & So, 2006; Gleitman et al., 2019). In NSL, agent-backgrounding appears to have emerged first through a lexical device and only later through a morphological device. If this asymmetry indicates a broader constraint on language emergence, then we predict that there may be homesigners who encode agent-backgrounding lexically but not morphologically, but not homesigners who show the reverse pattern.

3. Experiment 2: Homesign

3.1. Participants

We tested four adult Nicaraguan homesigners (F = 1; age: mean = 34, range = 29–38). These individuals are integrated into the social life of their local communities and families and displayed no apparent congenital conditions, aside from being deaf. These individuals have received limited or no formal education. The homesigners are not in contact with each other and have minimal exposure to deaf signers of NSL (Gagne, 2015).

3.2. Design, materials, procedure and coding

The design, stimuli and testing procedure were the same as in Experiment 1. The signs GLASSES, WOMAN, BEARD and HAIR were coded as agent labels since these signs referred iconically to the agent when they were produced by individual homesigners. We also considered variations of the NSL sign MAN as labels. Although none of the homesigners had regular or extended contact with NSL signers, the two homesigners who produced the MAN sign likely borrowed it from NSL through occasional contact. As in Experiment 1, we also included points to the chest as agent nominals. No homesigner produced a sign that appeared to be functioning as a person classifier.

The coding procedure for event descriptions was the same as in Experiment 1, as was the procedure for establishing reliability of event description coding. One-third of the homesign trials were coded for reliability, and we found a 93% agreement rate with respect to the predicate matching criteria described in Section 2.4. We did not calculate reliability across homesigners' agent nominals, as agent nominals were identified on an individual basis for each homesigner.

3.3. Results

3.3.1. Agent omission analysis

We first analyzed whether use of agent nominals differed across the four conditions. Two of the four homesigners never produced agent nominals. The other two who did produce agent nominals produced them systematically with respect to condition. Regarding the expression of agency, we found that neither of these two homesigners produced an agent nominal in the No Agent condition (nor did they produce them in the Event Control condition). Homesigners can thus use the lexicon to encode agency.

Turning next to agent nominals and agent-backgrounding, we found that Homesigner 2 produced at least one agent nominal on every Body-Agent trial, but on none of the Hand-Agent trials. Homesigner 3 showed the same pattern, albeit attenuated: he produced at least one agent nominal on 50% of the Body-Agent trials but on only 25% of the Hand-Agent trials. These results show that, for homesigners who produced agent nominals, these signs were more frequent when the face and torso of the agent were visible (i.e., Body-Agent trials) than when only the hand of the agent was visible (i.e., Hand-Agent trials). Thus, even at the earliest stages of language emergence, signers can use the lexical agent-omission strategy to convey agent-backgrounding. However, the strategy was used categorically by only one homesigner (Homesigner 2). Neither Homesigner 1 or 4 produced any agent nominals.

For the two homesigners who produced agent nominals, we analyzed whether there was a trade-off between agent and patient nominals across the four conditions. Patient nominals were coded based on iconicity (e.g., two flat hands joined on the long axis in a V-shape was coded as BOOK). Homesigner 2 showed uniform behavior across the four conditions, producing patient nominals on 3 out of 4 trials. Homesigner 3, however, produced patient nominals on only 1 Body-Agent trial but on 3 out of 4 trials for the other three conditions. For Homesigner 3, there may be a trade off between agent and patient nominals.

3.3.2. Predicate handshape analysis

We next analyzed whether homesigners distinguished the four event types (Body-Agent, Hand-Agent, No Agent and Event Control) through handshape in their predicates. Fig. 6 shows the average number of handling and non-handling predicates that the homesigners produced in each of the four conditions.

We analyzed predicate production using the Friedman rank sum test.[11] The number of handling predicates produced in each trial differed across the four conditions ($\chi^2(3) = 49.4$, $p < .001$). Comparing the Body-Agent condition to the other three conditions, signers produced more handling predicates in the Body-Agent condition than in the No Agent condition ($\chi^2(1) = 5.1$, $p < .05$). Production of handling handshapes did not differ, however, between the Body-Agent and Hand-Agent conditions ($\chi^2(1) = 0.06$, $p > .10$) or between the Body-Agent and Event Control conditions ($\chi^2(1) = 2.3$, p > .10). This result

[11] Although the dependent variable, number of predicates produced, is an interval variable, we used a non-parametric statistic given our small sample size.

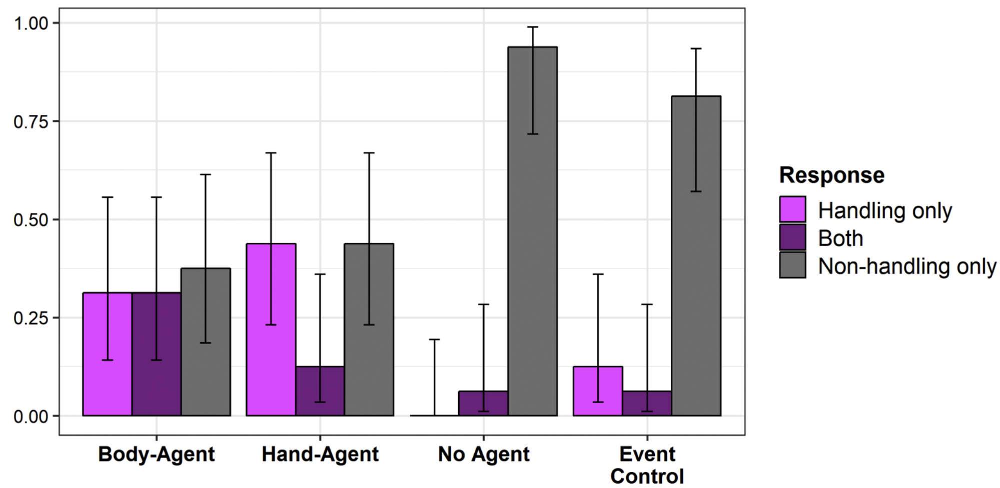

Fig. 7. Average proportion of homesign trials containing only handling handshapes, only non-handling handshapes, or both handling and non-handling handshapes in each condition. Error bars show binomial 95% confidence intervals calculated using the Wilson method.

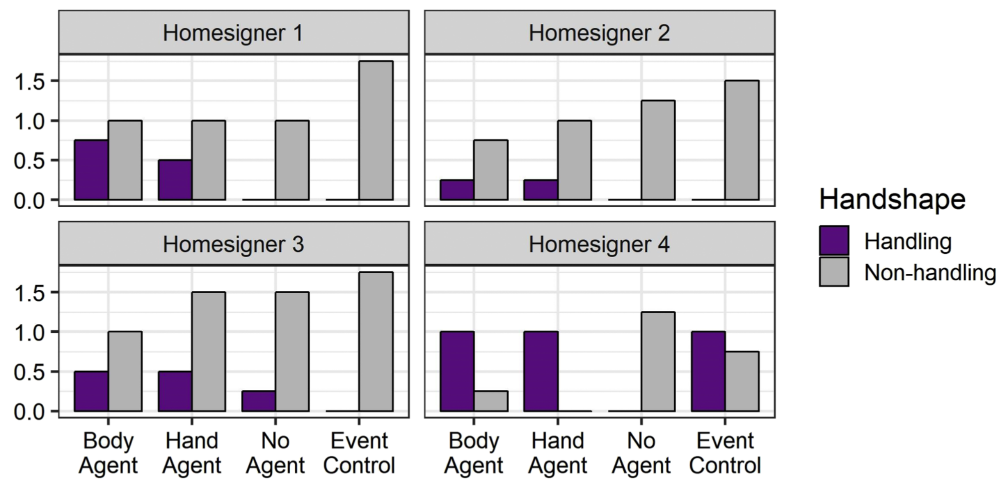

Fig. 8. Average number of handling and non-handling predicates produced per trial in each condition by each homesigner.

suggests that the homesigners used handling predicates to encode agency (the distribution of their handshapes differed between No Agent and Body-Agent), but not agent-backgrounding (the distribution of their handshapes did *not* differ between Body-Agent and Hand-Agent).

Turning to production of non-handling predicates, we found that the number of non-handling predicates also differed across the four conditions ($\chi^2(3) = 17.0$, $p < .001$). Homesigners produced more non-handling predicates in the Event Control condition than the Body-Agent condition ($\chi^2(1) = 4$, $p < .05$), and marginally more non-handling predicates in the No Agent condition than in the Body-Agent condition ($\chi^2(1) = 3.1, p = .08$). Non-handling predicates did not differ between the Body-Agent and Hand-Agent conditions ($\chi^2(1) = 0.06$, $p > .10$). This result suggests that homesigners used non-handling predicates to encode agency, but not to encode agent-backgrounding; that is, they displayed the same patterns in their lexical and morphological devices.

Analyzing the data at the level of the trial (Fig. 7), we found that, like NSL signers, homesigners primarily produced trials containing only non-handling handshapes in the No Agent condition, and only handling handshapes in the Body-Agent condition. With respect to the Hand-Agent condition, they resembled NSL 1 signers (and not the NSL 2 & 3 signers): they displayed the same distribution of handshapes in the Hand-Agent condition as in the Body-Agent condition. We evaluated the contrasts between the Body-Agent condition and each of the three other conditions using the Friedman rank sum test. The ranks were different across the four conditions ($\chi^2(3) = 50.1$, $p < .001$) and planned pairwise comparisons showed that ranks were significantly higher in the Body-Agent condition than in the No Agent condition ($\chi^2(1) = 5.1$, $p < .05$). Ranks did not differ, however, between the Body-Agent and Hand-Agent conditions ($\chi^2(1) = 0.06$, $p > .10$), and ranks were only marginally higher in the Body-Agent condition than the Event Control condition ($\chi^2(1) = 3.1$, $p = .08$). Thus, at the level of an entire utterance, homesigners encode agency but not agent-backgrounding (despite the fact that homesigners can use handshape to communicate about particularly patient-oriented events, i.e., the Event Control videos).

Averaging across the four homesigners provides a view into how likely an adult Nicaraguan homesigner is to distinguish the four event conditions. It is important to keep in mind, however, that homesigners do not share a linguistic system with each other (they do not know one another), nor even with their main communication partners (Carrigan & Coppola, 2017). As mentioned, homesigners sometimes show considerable variability in the types of linguistic structures present in their systems (Coppola, 2002; Coppola & So, 2006; Horton, 2018; Horton et al., 2017). Although the homesigners we studied showed no evidence of distinguishing the Body-Agent and Hand-Agent events in the aggregate, there may be evidence that individual homesigners do so. Figs. 8–9 show individual homesigner data: the average number of handling and non-handling predicates produced in each condition (Fig. 8) and the proportion of trials falling under each by-trial strategy type in each condition (Fig. 9).

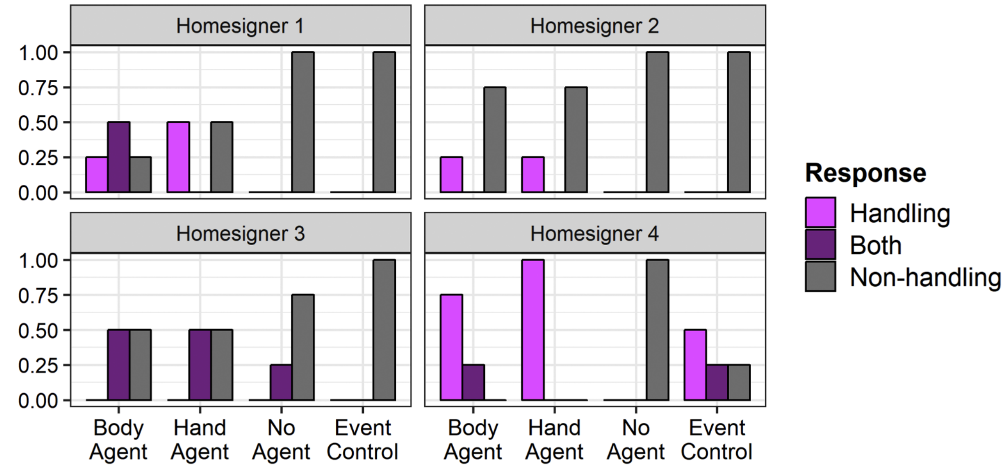

Fig. 9. Proportion of homesign trials containing only handling handshapes, only non-handling handshapes, or both handling and non-handling handshapes in each condition by each homesigner.

Figs. 8–9 show that individual signers encode a distinction between agentive and non-agentive events: all four homesigners produce more handling predicates in the Body-Agent condition than the No Agent condition. In addition, three homesigners produce more non-handling predicates in the No Agent condition than the Body-Agent condition. All four homesigners produce a greater proportion of non-handling-only trials in the No Agent condition than the Body-Agent condition. Interestingly, the two homesigners who distinguish Body-Agent and No Agent videos most clearly through handshape (Homesigners 1 & 4) are the two homesigners who never produced agent nominals.

In contrast to encoding agency, encoding agent-backgrounding at the individual level is less clear. Each homesigner displayed similar patterns in Body-Agent and Hand-Agent videos (although the pattern was not the same across the four homesigners). Fig. 9 shows that Homesigners 2 and 3 used identical response strategies across the Body-Agent and Hand-Agent conditions. Homesigner 1 produced both handling and non-handling predicates in the Body-Agent condition but not in the Hand-Agent condition. This distinction is the reverse of the NSL 2 & 3 pattern shown in Fig. 5. In summary, none of the four homesigners showed a clear morphological distinction between Body-Agent and Hand-Agent.

3.4. Discussion

The results of Study 2 show, in line with previous research, that homesigners robustly use a morphological strategy (handshape in event descriptions) to encode a distinction between agentive events and non-agentive events. We find minimal evidence, however, for morphological encoding of *agent-backgrounding* among homesigners. At the group level, homesigners did not use handshape to distinguish Body-Agent events from Hand-Agent events, and there was no strong evidence that individual homesigners do so (despite the fact that homesigners were able to use non-handling handshapes to encode a conceptually prominent patient in the Event Control videos). Recall from Section 2.5.2 that all ten NSL 2 & 3 signers showed at least one of the following patterns: producing more handling-only responses in Body-Agent than in Hand-Agent, or producing more non-handling-only responses in Hand-Agent than in Body-Agent. By contrast, only one homesigner (Homesigner 1) showed one of these patterns (and this homesigner showed a mixed response not clearly indicating agent-backgrounding; see Fig. 9). In total, these results are consistent with the model of language evolution proposed in Heine and Kuteva (2007), that language that encodes agent-backgrounding emerges *after* language that distinguishes agents from non-agents.

The agent nominal data for homesigners also supports this conclusion, but more tentatively, as only two out of four homesigners produced any agent nominals. Nonetheless, both of these homesigners used agent nominals to distinguish agentive events from non-agentive events, whereas only one homesigner (Homesigner 2) made a sharp distinction between Body-Agent and Hand-Agent events using agent nominals. The pattern shown by Homesigner 2 suggests that agent-backgrounding emerges through lexical devices before morphological devices.

One explanation for the results in Experiments 1 and 2 is that homesigners and NSL 1 signers are more limited in the range of semantic distinctions they can encode than NSL 2 & 3 signers are. This explanation may seem counterintuitive—if a group of signers is able to use distribution of handling and non-handling predicates to distinguish agentive from non-agentive videos, why would they not be able to contrastively distribute the same predicates to encode agent-backgrounding? In Experiment 3, we ask whether a limitation in the available communication system can, in principle, prevent participants from distinguishing Body-Agent from Hand-Agent videos. In this experiment, English-speaking adults described the stimuli using only their hands (a “silent gesture” study, Goldin-Meadow, McNeill, & Singleton, 1996; Goldin-Meadow, So, Özyürek, & Mylander, 2008). We know from previous work that English speakers conceptually distinguish Body-Agent and Hand-Agent scenes and encode this distinction in their language in an experimental setting (Rissman et al., 2019; footnote 4). But the silent gesture paradigm imposes significant restrictions on the mode of English speakers' communication. That is, since English speakers are unaccustomed to having the manual modality be their sole channel of communication, they are limited in their ability to utilize this communicative channel. If silent gesturers encode agency but not agent-backgrounding, we would have in-principle evidence that limitations in the linguistic system could account for homesigners and NSL 1 signers not encoding agent-backgrounding via handshape morphology.

4. Experiment 3: Silent gesture

4.1. Participants

12 adult native English speakers participated in Experiment 3 (F = 6, mean age = 26, range = 18–77). These speakers did not have experience with a signed language. An additional two participants were tested but were excluded for having studied American Sign Language. Participants were tested on the University of Chicago campus and received either course credit or $5 as compensation.

4.2. Design, materials, procedure and coding

The design and stimuli were the same as in Experiments 1–2. Participants were instructed to describe the videos without using their voice, using only their hands, arms, face or body; i.e., "silent gesture". Participants were also instructed not to stand up from their chair or use physical props in their descriptions. Participants completed two practice videos so that the experimenter could verify that they were comfortable producing descriptions without their voice.

Gesturers did not routinely produce labels for the agent (e.g., MAN, WOMAN), possibly because these meanings are non-trivial to convey iconically and gesturers do not share a conventionalized lexicon. Some gesturers produced a 2-legged stick figure with their middle and index fingers in an inverted V-shape, which were coded as agent nominals. Deictic gestures referencing either the signer's body or the stick figure gesture itself were also coded as agent nominals. As with the homesign data, we did not calculate reliability across the gesturers' agent nominals, as these were identified on an individual basis.

The coding procedure for event descriptions was the same as in Experiments 1–2. In general, the handshapes of the silent gesturers were looser and more difficult to categorize than the handshapes of the signers and the homesigners. For this reason, two coders coded handshape for all of the silent gesture descriptions, and the second coder reported her confidence about the handshape coding (1 = not at all confident, 2 = moderately confident, 3 = completely confident). We calculated agreement between the two handshape codings (handling vs. non-handling handshape) across all predicates. Agreement was 57% for confidence level 1, 88% for confidence level 2, and 100% for confidence level 3. We excluded predicates with confidence level 1 from further analysis ($N = 7$). For the remaining predicates, overall agreement between the two codings was 91%.

4.3. Results

4.3.1. Agent omission analysis

Only four of the 12 gesturers produced agent nominals. One of these gesturers produced agent nominals on 100% of Body-Agent trials and 50% of Hand-Agent trials (nine agent nominals in total). The other three gesturers produced agent nominals only in the Body-Agent condition, producing five, two and one agent nominals, respectively. Agent omission does not thus appear to be a robust strategy for encoding either agency or agent-backgrounding in silent gesture, although a few gesturers may be using agent nominals systematically. The two gesturers who produced a sizeable number of agent nominals patterned like Homesigners 2–3, with more agent labels in the Body-Agent condition than in the Hand-Agent condition.

4.3.2. Predicate handshape analysis

The gesturers failed to produce a predicate on only 2% of trials; these trials were excluded from analysis. Fig. 10 shows the average number of handling and non-handling predicates that gesturers produced in each of the four conditions.

We analyzed production of handling and non-handling predicates using mixed effects models and the *lme4* package for R, assuming an underlying Poisson distribution. The best-fitting model of *handling* handshape production included the Condition effect. Gesturers produced fewer handling predicates in the No Agent condition than in the Body-Agent condition ($\beta = -1.47$, SE = 0.34, $p < .001$). Handling handshape production did not differ, however, between Body-Agent and Hand-Agent ($\beta = -0.13$, SE = 0.22, $p > .1$), or between Body-Agent and Event Control ($\beta = -0.24$, SE = 0.22, $p > .1$). The best-fitting model of *non-handling* predicate production also included the Condition effect. Gesturers produced more non-handling predicates in the No Agent condition than in the Body-Agent condition ($\beta = 1.08$, SE = 0.27, $p < .001$). Production of non-handling predicates did not differ, however, between the Hand-Agent and Body-Agent ($\beta = 0.38$, SE = 0.30, $p > .1$) or between Event Control and Body-Agent ($\beta = 0.45$, SE = 0.30, $p < .01$).

Analyzing handshape strategy at the level of the trial (Fig. 11), we find that gesturers clearly distinguished the Body-Agent and No Agent conditions: 'only handling' was the predominant response for Body-Agent trials, whereas 'only non-handling' was the predominant response for No Agent trials. However, Hand-Agent trials were similar to Body-Agent trials—'only handling' was the predominant response in both types of trials, as it was in Event Control trials; silent gesturers thus do not distinguish Body-Agent from Event Control trials to the same degree that NSL signers and homesigners do.

We evaluated the contrasts between the Body-Agent condition and each of the three other conditions using the Friedman rank sum test. For silent gesture, the ranks were different across the four conditions ($\chi^2(3) = 22.3$, $p < .01$) and planned pairwise comparisons showed that ranks were significantly higher in the Body-Agent condition than in the No Agent condition ($\chi^2(1) = 18.7$, $p < .01$). Ranks did not differ, however, between the Body-Agent and Hand-Agent conditions ($\chi^2(1) = 1.1$, $p > .10$), or between the Body-Agent and Event Control conditions ($\chi^2(1) = 1.4$, $p > .1$).

4.4. Discussion

Like the NSL signers and homesigners, silent gesturers used handshape robustly to encode agency (handling handshape in Body-Agent vs. non-handling handshape in No Agent events). This finding underscores the prominence of the iconic mapping between agency and handling handshape, as even hearing speakers with minimal experience communicating solely in the manual modality were able to draw on this iconicity.

Beyond agency, however, silent gesturers' linguistic expression was limited. Like NSL 1 signers and homesigners, they did not use handshape to encode agent-backgrounding. In contrast to these two types of signers, however, silent gesturers also failed to distinguish Body-Agent videos from Event Control videos. As English speakers make both distinctions when using English (see footnote 4), this result suggests that forcing English speakers to use an unfamiliar mode of communication dramatically reduces the range of meanings they are able to convey.

We know from previous studies that, when speaking, English speakers encode the agent in Hand-Agent videos as less conceptually prominent than the agent in Body-Agent videos (Rissman et al., 2019). We also know that English speakers are pragmatically motivated to linguistically encode this distinction in an experimental setting, which they do by increasing their use of passive voice in the Hand-Agent condition. Experiment 3 therefore provides a "proof of concept" that restrictions on the communication system can prevent a participant from encoding agent-backgrounding. The conceptual and pragmatic foundations for expressing a meaning can be present even if this meaning is not expressed linguistically.

5. General discussion

At the outset of this paper, we raised three questions: first, is agent-backgrounding communicatively important enough to arise in an emerging language? Second, if it is, does agent-backgrounding arise at the same moment as agency? Third, at what point in the development of a language does it emerge – in homesign, in the context of a linguistic community, or in the context of both a linguistic community and a linguistic model? We draw three conclusions from the results reported here, corresponding to these three questions: first, agent-backgrounding has high communicative importance. We found that agent-backgrounding was expressed through agent omission in NSL 1 (the first generation to have had a linguistic community) and through handshape morphology in NSL 2 & 3 (the first generation to have had a linguistic model). Second, agent-backgrounding does not have the same core cognitive status as agency. Across the three levels of emergence,

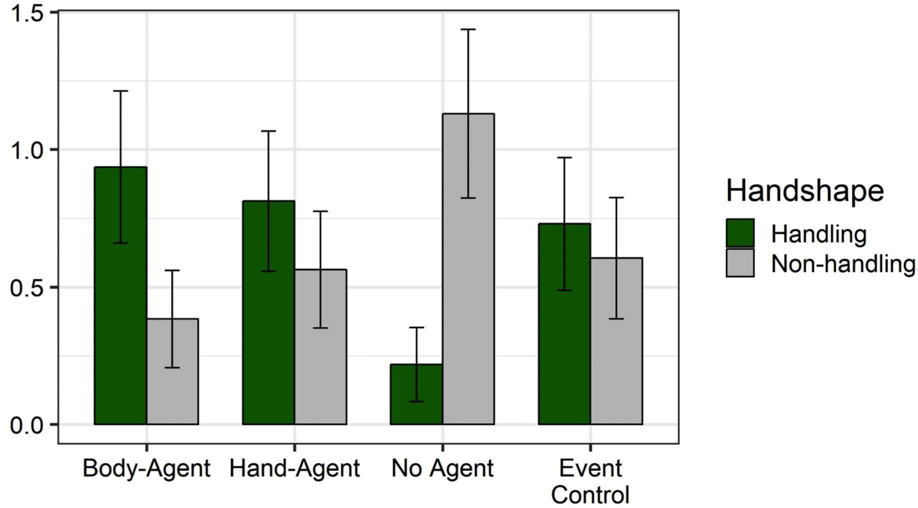

Fig. 10. Average number of handling and non-handling predicates produced by silent gesturers per trial in each condition. Error bars show Poisson 95% confidence intervals.

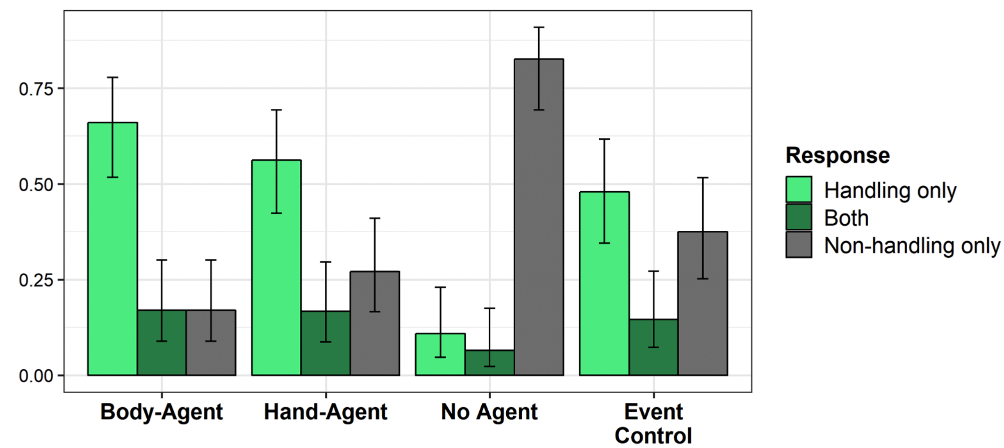

Fig. 11. Average proportion of silent gesture trials containing only handling handshapes, only non-handling handshapes, or both handling and non-handling handshapes in each condition. Error bars show binomial 95% confidence intervals calculated using the Wilson method.

linguistic devices for expressing agent-backgrounding did not emerge at the same time as linguistic devices for expressing agency. This pattern held for both a lexical device (omission of an agent nominal) and a morphological device (distribution of handshape in classifier predicates). Third, receiving a linguistic system where agentive devices were firmly established was necessary for the emergence of agent-backgrounding morphology in NSL. In the sections that follow, we discuss each of these conclusions and then consider how the linguistic structures that we observed relate to broader typological patterns in encoding of agent-backgrounding.

5.1. Communicative importance and core knowledge

Our results suggest that being able to deemphasize the role of the agent in an event has deep communicative value. This result is perhaps surprising, as English-speakers are often taught in school that passive voice is communicatively inferior to active voice (see Ferreira, 2020). On the contrary, our findings underscore the importance of cognitive flexibility in shaping the range of linguistic structures that humans have innovated. As language users we want to convey not only who did what to whom – a representation which is strongly grounded in external reality – but also our particular perspective on events and individuals in the world. The finding that agent-backgrounding devices emerged so rapidly in NSL predicts that agent-backgrounding constructions are universal or nearly-universal across the established languages of the world.

At the same time, agent-backgrounding does not appear to have the same level of communicative importance as agency. This finding, in turn, suggests that agent-backgrounding is not part of the core system of agency proposed by Carey (2009). This result helps delimit the scope of core cognition: as described earlier in Section 1, Gleitman et al. (2019) argue that distinguishing symmetrical versus reciprocal construals of events (a type of flexibility in event representation) does have a core, foundational status.

Exploring the relatively slower emergence of agent-backgrounding in more detail, we offer three explanations for why homesigners and NSL 1 signers did not use handshape morphology to encode agent-backgrounding. First, they may be less pragmatically motivated to distinguish these events linguistically than NSL 2 & 3 signers. Second, they may not represent the conceptual distinction between Body-Agent and Hand-Agent scenes to the same degree that NSL 2 & 3 signers do. Third, their morphosyntactic systems may not provide a means to distinguish these events. These explanations are not mutually exclusive.

The first possibility is that NSL 1 signers were less pragmatically motivated to distinguish Body-Agent vs. Hand-Agent videos through language than NSL 2 & 3 signers. These two types of videos have many similarities and distinguishing between them may involve high-level reasoning about the desires and expectations of the experimenters, reasoning that may have been easier for NSL 2 & 3 signers than NSL 1 signers. This explanation is undercut, however, by the fact that NSL 1 signers did use agent nominals to distinguish Body-Agent from Hand-Agent videos. The agent nominals finding shows that NSL 1 signers not only attended to differences between the videos but were also motivated to use language to encode these differences. In fact, one of the homesigners (Homesigner 2) robustly used agent nominals to distinguish Body-Agent from Hand-Agent videos.

Considering the second, conceptual explanation, we note that some conceptual differences between cohorts of NSL have been documented. Relative to NSL 2 signers, NSL 1 signers show poorer theory of mind performance (e.g., predicting a person's behavior when that person has a false belief, Pyers & Senghas, 2009), as well as poorer spatial cognition (e.g., searching for a hidden object after disorientation, Pyers et al., 2010). It is possible that construing an agentive scene from a patient-oriented perspective requires cognitive flexibility, and that NSL 2 & 3 signers are more cognitively flexible than NSL 1 signers. In Section 3.3.1, we showed that NSL 1 signers were able to use agent nominals to distinguish Body-Agent scenes from Hand-Agent scenes. This finding shows that NSL 1 signers attended to and conceptualized differences between these scenes, although we cannot be sure that NSL 1 signers construed the Hand-Agent scenes from a patient-oriented perspective to the same degree that NSL 2 & 3 signers did.

The third possibility is that homesigners and NSL 1 signers did not use handshape morphology to distinguish Body-Agent from Hand-Agent scenes because of limitations on the structure of their language. This hypothesis is a reasonable explanation for the fact that the silent gesturers in Experiment 3 did not use handshape morphology to distinguish between Body-Agent and Hand-Agent videos. These English speakers clearly have the conceptual and pragmatic tools to make this distinction, and they use handshape to make a related distinction between agentive and non-agentive events. But their ability to encode agent-backgrounding seems to be thwarted by their undeveloped communication systems.

The dominant strategy for NSL 2 & 3 signers in the Body-Agent condition was to produce *only* handling predicates, whereas their dominant strategy in the Hand-Agent condition was to produce *both* handling and non-handling predicates. Importantly, NSL 1 signers did produce *both* handling and non-handling predicates in combination in the Event Control condition, making it clear that they were able to produce this type of response for events with a highly prominent patient. Thus, what seems to be missing for NSL 1 signers is a mapping from handshape form to the agent-backgrounding function.

A similar point can be made for homesigners. As a group, they used handling predicates on their own, as well as handling and non-handling predicates in combination, to distinguish Body-Agent from No Agent videos. They also used non-handling handshapes to distinguish Body-Agent from Event Control videos, a strategy which they could have extended to the Hand-Agent videos. Comparable to the NSL 1 signers, the homesigners' linguistic systems appear to lack a mapping from handshape form to the agent-backgrounding function.

Before we continue, one note of caution is warranted: the manipulation we used, excluding the face/torso of the agent, is only one way of eliciting agent-backgrounded event construals and agent-backgrounding constructions. It is possible that a different manipulation could have led the homesigners and NSL 1 signers to use handshape morphology to encode agent-backgrounding. It is also possible that homesigners and NSL 1 signers distinguished these types of events in our data through a linguistic device that we were not sensitive to and did not code. Nonetheless, the differences we see in the types of semantic distinctions made by signers in the different cohorts provide compelling evidence for an asymmetry between agency and agent-backgrounding.

5.2. Precursors to the emergence of agent-backgrounding

In situations of language emergence, language users draw on the existing structures in their language to innovate new form/meaning mappings. A primary goal of our study was to understand the linguistic building blocks and communicative dynamics that would enable the innovation of agent-backgrounding constructions. Toward creating agent-backgrounding morphology, our results point to the likely importance of receiving a linguistic system in which agentive devices were already well-established, as NSL 2 & 3 signers received.

Neither homesigners nor NSL 1 signers distinguished Body-Agent from Hand-Agent events using handshape, but this does not mean that these two groups used handshape morphology in identical ways. For the first cohort of NSL, the contrast between Body-Agent events and No Agent events is sharper than it is for homesigners. In the No Agent condition, both groups of signers overwhelmingly produced trials with *only* non-handling predicates. Homesigners also produced *only* non-handling responses on 38% of Body-Agent trials. By contrast, NSL 1 signers never produced a trial that included only non-handling predicates in the Body-Agent condition.

Across cohorts of NSL signers, a handling predicate was produced at least once on every trial that had an unambiguous agent (i.e., Body-Agent trials). The clarity of the mapping between agency and handling handshape may have paved the way for agent-backgrounding to emerge. In Body-Agent and Hand-Agent trials, NSL 1 signers produced a non-handling predicate on roughly 50% of trials. This behavior may reflect a desire to represent the changed state of the patient as a separate event component, a desire that could arise even for unambiguously agentive events (see Loos, 2017). The system used by NSL 1 signers served as input to NSL 2 signers. It is therefore possible that NSL 2 signers received these non-obligatory, non-handling predicates and grammaticalized them to serve a semantic purpose: encoding agent-backgrounding.

This hypothesis, that receiving a linguistic system with clear agentive morphology enables the emergence of agent-backgrounding morphology, may be tested using artificial language learning paradigms (see Kirby, Cornish, & Smith, 2008, inter alia). Recall from Experiment 3 that silent gesturers used handshape morphology to distinguish Body-Agent events from No Agent events, but less sharply than NSL 1 signers did. We predict that silent gesturers who receive this probabilistic system as input will not innovate agent-backgrounding handshape morphology, but silent gesturers receiving a categorical agent-marking morphological system will.

One prior study that we are aware of has investigated agent-backgrounding constructions in emerging signed languages: Horton et al. (2017) found that one out of four child homesigners showed a pattern of results similar to the NSL 2 & 3 signers, using handshape morphology to express both agency and agent-backgrounding. At first glance, this result appears incompatible with our conclusion that agent-backgrounding does not have the same priority for linguistic encoding as agency. A more in-depth look reveals, however, that this child homesigner has a deaf homesigning parent. It may therefore be the case that this child received a homesign system from her parent in which morphological marking of agency was already clear-cut, compatible with the dynamics of agent-backgrounding emergence that we observed in NSL.

5.3. Typology and the future of NSL

In this final section, we consider the trajectory of change from homesigners to NSL 1 to NSL 2 & 3 and how the NSL findings fit into a broader typological perspective. We found an asymmetry between the lexical strategy and the morphological strategy for encoding agent-backgrounding, with the former emerging before the latter in NSL. This observation raises the question of how agent-backgrounding will continue to grammaticalize in NSL. We observed that the predominant strategy for NSL 2 & 3 signers in the Hand-Agent condition was to produce handling and non-handling predicates in combination. To the extent that these groupings of signs are represented as a unit, we might be observing the emergence of a serial verb structure (see the Mandarin serial verb passive in example 4). As described in Section 2.5.3, the majority of the "Both" trials featured the consecutive sequence [handling – non-handling]. As NSL continues to evolve, this dominant pattern may become even more prevalent.

Regarding the interaction between agent nominals and handshape, Table 2 shows that NSL 2 & 3 signers sometimes described Hand-Agent videos with utterances where there were no agent nominals and only non-handling predicates. It is unclear whether such utterances would be interpreted as depicting agentive events if they were produced outside the context of the experiment (keeping in mind the standard caveat that we do not know whether we coded all of the agentive devices that NSL signers have at their disposal). If such utterances are ambiguous between agent-backgrounded and non-agentive interpretations, then we would expect them to be disfavored among future generations of NSL.

Turning to how NSL is positioned within linguistic typology, we found that all cohorts of NSL and one homesigner used an agent omission strategy to convey agent-backgrounding. As discussed in Section 1.2, this device is attested for other sign languages. We did not find evidence, however, that NSL uses impersonal constructions for agent-backgrounding (e.g., using signs such as ONE or PERSON to convey non-specific reference), which are also well-documented across sign languages (Barberà & Hofherr, 2018). We are not aware of studies investigating directly whether signers of more established sign languages use handshape in classifier predicates to convey agent-backgrounding. Nonetheless, signers across a range of languages have been shown to use object handshape classifiers when describing agentive events (Goldin-Meadow et al., 2015; Kimmelman, de Lint, et al., 2019). Future research can address whether these classifiers are serving an agent-backgrounding function.

6. Conclusion

Ours is one of the first studies investigating the emergence of agent-backgrounding constructions in young languages. We found that users of an emerging language innovated agent-backgrounding constructions, indicating the communicative importance of downplaying the role of an agent in an event. At the same time, we found that agent-backgrounding language did not emerge at the same time as agentive language in NSL, homesign, and silent gesture, suggesting that agent-backgrounding does not have the same core status as agency. We also observed different trajectories of emergence for different types of linguistic devices—agent-backgrounding emerged first through a lexical strategy (omission of an agent nominal) and then through handshape morphology in classifier predicates. For signers to innovate agent-backgrounding morphology, having a linguistic model to build from appears to be a necessary precondition.

CRediT authorship contribution statement

Lilia Rissman:Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization, Supervision, Funding acquisition.**Laura Horton**:Conceptualization, - Methodology, Data curation, Writing - original draft.**Molly Flaherty**:Methodology, Investigation, Writing - original draft.**Ann Senghas**:Investigation, Writing - original draft, Writing - review & editing.**Marie Coppola**:Investigation, Writing - original draft, Writing - review & editing, Funding acquisition.**Diane Brentari**: Conceptualization, Methodology, Writing - original draft, Writing - review & editing, Funding acquisition. **Susan Goldin-Meadow**:Conceptualization, Methodology, Writing - original draft, Writing - review & editing, Funding acquisition.

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